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Description of a thermometrical Barometer for measuring Altitudes. *By the Rev.* Francis John Hyde Wollaston, *B.D. F.R.S.* Read March 6, 1817. [*Phil. Trans.* 1817, *p.* 183.]

The author's attention having been drawn to the variations in the heat of boiling water, as corresponding with changes in atmospherical pressure and in the height of the barometer, he was led to construct the instrument described in the present paper, for the purpose of measuring heights with greater accuracy and convenience than by the common barometer, or by the methods formerly devised by Fahrenheit and Cavallo.

The author constructed his thermometer with different scales, from an uncertainty how far their sensibility might be carried; and in one instance the bore of the tube was so minute, and the ball so large, that every degree on Fahrenheit's scale was equal to ten inches. The instrument, however, with which the greatest number of observations were made, had a scale of 3·98 inches to every degree, and each degree is divided into 100 parts upon the scale, and into 1000 by a vernier. On comparing this thermometer with a good barometer, it was found that the two instruments agreed equally well in all parts between 30·68 inches and 28·23 inches. The result was, that a difference of 1° of Fahrenheit's scale is occasioned by 0·589 inch on the barometer; 30·603 inches (corrected) on the barometer, =213°·367 on the thermometer, and 28·191 inches barometer, =209°·263 thermometer.

Having thus ascertained the delicacy and capability of the instrument, the author proceeds to describe the best mode of constructing it, which is further illustrated by an annexed drawing. To the vernier is attached a small lens of an inch focus, which, on account of the smallness of the bore of the tube, is useful in observing the height of the mercurial thread, and by having no lateral motion, confines the view to the same direction, thus preventing parallax.

The boiler of this instrument is a tin cylinder 5·5 inches deep, and 1·2 inches in diameter, with an external cylinder 1·4 inch diameter, for preventing the transmission of heat. The bottom is single, and the bulb does not dip into the water, but is exposed to the steam only; and a bell-tent protects the lamp and boiler from the wind. The lamp is filled with oil, to which a sufficient quantity of tallow is added to make it congeal at common temperatures.

Having tried threads of various thicknesses, the author advises the scale of an inch to a degree as best adapted to all ordinary purposes; for when finer than this, it is almost impossible to give such strength to the bulb as to force the column of mercury accurately to the same height on repetition of the boiling, by reason of the resistance from friction in the tube.

With an inch scale, the variations of the barometrical thermometer are to those of the common barometer as 5:3; and the sensibility of the instrument is such, that the difference of temperature required to make water boil arising from the height of a common table, is imme-

diately perceptible. After stating the methods for adjusting this thermometer for the measurement of the greatest heights, the author details some experiments upon altitudes made with an instrument, 552 parts upon the scale of which were equal to 530 feet in altitude. With this instrument boiled on the counter of a bookseller's shop in Paternoster-row, estimated between four and five feet above the foot pavement on the north side of St. Paul's Churchyard, and boiled again in the gilt gallery of the cathedral, there was a difference of 254 parts; the corrected height thus indicated therefore = 272·64 feet. General Roy makes the gallery above the north pavement to be 281 feet, which, allowing five feet for the difference of station, brings the author's estimate to 267 feet, differing only four feet; or by another calculation, founded on General Roy's statement, the difference is less than two feet.

Observations on the Analogy which subsists between the Calculus of Functions and other branches of Analysis. By Charles Babbage, *Esq. M.A. F.R.S.* Read April 17, 1817. [*Phil. Trans.* 1817, *p.* 197.]

At the commencement of this paper the author states the advantages which may be derived from the employment of analogical reasoning in mathematics, and recommends it as a very useful guide to new discoveries: he then proceeds to point out the striking resemblance which subsists between several parts of common algebra and the integral calculus, and similar parts of the calculus of functions.

Mr. Babbage then notices certain fractions which, by peculiar relations among the functions of which they consist, become evanescent. The true values of these fractions are ascertained, and they are applied to the solution of a class of functional equations which the author had solved in a former paper, from which the following result is obtained:—"Whenever the mode of solution there adopted seems to fail, the failure is *apparent* only, and the general solution may always be deduced from it."

Several points of resemblance between the integral calculus and that of functions, are then noticed; and a remarkable analogy between a method of integrating differential equations, and a mode of solving functional equations, is pointed out; in both cases the operations are performed by multiplying by a factor, whose form is to be determined by another equation. Some equations are given in which this method is successful, and the obstacles to its general application are pointed out as demanding further inquiry.

Of the Construction of Logarithmic Tables. By Thomas Knight, *Esq. Communicated by* Taylor Combe, *Esq. Sec. R.S.* Read February 27, 1817. [*Phil. Trans.* 1817, *p.* 217.]